

Interim Report to the

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION

on

BUILDING-RELATED HEALTH CONCERNS

at the

SILVER SPRING METRO COMPLEX

June 26, 2000

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Executive Summary

This report summarizes current health-related information as part of an ongoing program of indoor air quality management at the National Oceanic and Atmospheric Administration (NOAA) facility known as the Silver Spring Metro Complex (SSMC). It includes a review of information collected by building occupants, the SSMC Health Unit, and an internal medicine/ occupational medicine consultant at the Health Unit. The purpose of this report is: (1) to review the health data that has been collected; (2) to review the environmental sampling data; and (3) to put these together and make recommendations for the continued management of the health of the population and building.

The principal findings of the report are:

- There is no evidence of a widespread systemic illness within occupants of the building, based on the symptom sheets, reports from the Health Unit, or evaluations by the consulting occupational medicine/ internal medicine specialist. The symptoms reported by many of the occupants are consistent with a number of diagnoses, rather than one single diagnosis.
- The pattern of reported respiratory symptoms is in many cases consistent with allergic disorders including asthma and allergic rhinitis, some of which may have first developed while the occupants were in the building, and some of which has exacerbated pre-existing conditions.
- There is evidence of mold growth in many areas of the buildings that have been tested. While it does not appear that one species has taken over large areas of the building (a so-called Aovergrowth@), it does appear that there are many focal areas of growth, which would be consistent with, for example, widespread moisture intrusion. This could explain a significant percentage (although not all) of the allergic symptoms reported in the building.
- There are also individuals whose symptoms are most consistent with sick building syndrome, which is characterized by fatigue, skin irritation, headache, in some cases a dry cough, and irritated eyes.

The principal recommendations are:

1. For individuals whose allergies appear to be worse at work, if there is visible mold contamination or water intrusion (which almost by definition will increase the possibility of mold growth) these conditions should be corrected, if possible. It is always difficult to relate allergic symptoms to specific biological species; testing of individuals for specific mold allergies is unlikely to be of much value in determining whether individual mold species in the building are the cause of symptoms.
2. From a health standpoint, additional testing of the building for mold and fungi does not appear to be cost-effective. There is clearly evidence of local growth in selected areas, probably due to water intrusion; additional testing will not clarify the health issues of individual employees and seems most appropriate after a cleanup is completed, as well as part of a normal maintenance and surveillance program.
3. A number of individuals note symptoms consistent with sick building syndrome. While no one technical fix is likely to solve these problems, the operation and maintenance of the ventilation system should be optimized, so that obvious problems (areas of inadequate ventilation or temperature regulation, for example) can be minimized. Other environmental factors (e.g., lighting, ergonomics) may also need to be addressed.

Introduction

This report summarizes current health-related information as part of an ongoing program of indoor air quality management at the National Oceanic and Atmospheric Administration (NOAA) facility known as the Silver Spring Metro Complex (SSMC). It includes a review of information collected by building occupants, the SSMC Health Unit, and an internal medicine/ occupational medicine consultant at the Health Unit. The purpose of this report is: (1) to review the health data that has been collected; (2) to review the environmental sampling data; and (3) to put these together and make recommendations for the continued management of the health of the population and building. It should be noted that no confidential personal medical data were reviewed or are discussed in the preparation of the report. Further, any recommendations in the report are not meant to supersede personal medical recommendations to building employees by their treating physicians.

Throughout this report, there is a distinction between the terms Abuilding-related illness@ and Asick building syndrome@. [\[1\]](#) A building-related illness is any disease or diagnosable condition that can be shown to be related to the building. This relationship may be causal, i.e., an agent (or agents) specific to the building causes an illness that

would otherwise not have occurred. It could also be contributory, in that a pre-existing condition (or one that would have appeared anyhow) is either worsened or revealed sooner than it otherwise would have. In both cases, the assumption of a building-related illness is that there is a specific exposure within the building that can be identified and linked to the condition (for example, mold and allergies, or some infectious agent and a specific disease caused by that agent). While it may be difficult to identify the precise organism or agent responsible (most notably, in conditions such as allergic or irritant rhinitis or asthma), there is still a diagnosable condition that is worsened at work.

Sick building syndrome (SBS) is a unique syndrome with no known cause or mechanism. The clinical characteristics of the syndrome include mucous membrane (eye, nose, and throat) irritation, central nervous system symptoms (headache, fatigue, and lethargy), chest tightness, skin complaints (dryness, itching, and redness) and odor sensitivity. Although some consider that SBS should be diagnosed only in the setting of a building where a significant portion of the occupants are affected, the diagnosis is really a clinical diagnosis, rather than an epidemiologic description. Studies show that even in modern office buildings where there are no appreciable structural problems, a significant percentage of occupants frequently note one or more symptoms consistent with sick building syndrome. However, in the clinical setting of an individual with SBS symptoms that occur only at work and that are not explained by other medical diagnoses (particularly if there are more than a few such individuals or they tend to be in one area), it can be useful to make a provisional diagnosis of SBS and look at ways of improving ventilation or housekeeping within the building. It must be emphasized to the affected individuals, however, that while changes in building operations may improve some symptoms, it frequently does not eliminate them completely. In addition, the physician is obligated to continue looking for other contributing or causal factors unrelated to the building.

Building Symptom Surveys

Several symptom surveys of building occupants have been conducted in the various SSMC buildings over the past year.

The survey of SSMC-3 in October, 1999 showed the following results (table 1). Irritated eyes, stuffy nose, and drowsiness were also frequently reported.

Table 1. Frequency of symptoms reported among occupants of SSMC-3 (October, 1999)

Symptom	Population Reporting Symptom	Floors Most Severely Affected
Allergic symptoms (sinus congestion, sinusitis)	6 - 28%	5, 10-11, 13-15
Dry cough	5 - 40%	6-8, 10-11, 13-15
Fatigue	0 - 37%	15
Headache	12 - 46%	All except 5, 7

Sinus congestion	0 - 31%	2, 7, 11, 13-15
Sore or dry throat	0 - 37%	2, 3, 10, 15

Health Unit Symptom Reporting

Personnel in the Health Unit at SSMC-3 have also reported symptoms, most notably during April B June, 1999. The symptoms reported included: skin itching, a rash, headache, dry cough, sore throat, and tingling of the lips. Several individuals reportedly had abnormal spirometry (lung function tests), although their spirograms have not been reviewed to determine the precise nature of the abnormalities. Subsequently personnel were relocated from the Health Unit in that building.

Health Unit Intake Symptom Questionnaires

Beginning late in 1999, the Health Unit has collected front sheets from individuals with IAQ concerns who self-referred to the Unit. The front sheets request a voluntary disclosure (with signed consent) of reported symptoms. A review of these front sheets reveals several trends. First, several employees report symptoms that are consistent with sick building syndrome (irritated, dry or watery eyes, dry or itching skin, chest tightness or burning, drowsiness or fatigue, headache, and sometimes dry or scratchy throat with or without cough). A second group of employees noted allergic-type symptoms, including asthma, bronchitis, productive cough, sinus congestion, sinusitis, and other assorted symptoms. There were some other scattered symptoms, but these were the predominant patterns.

Review by Internal Medicine/Occupational Medicine Consultant

Dr. Hung-Tzi An, a physician trained in both internal and occupational/environmental medicine, has been evaluating building occupants with health concerns at the SSMC Health Unit. Individuals have been referred to her on a voluntary basis, based on their stated concerns or symptoms. Her confidential clinical impressions are conveyed to each individual, and remain within his or her personal medical file in the Health Unit. Where indicated, Dr. An has recommended either modification of the workplace, removal or relocation of the employee, or further diagnostic evaluation by a primary care physician.

To preserve confidentiality, no medical files were directly reviewed in the preparation of this report. However, Dr. An summarized her general impressions of the group of individuals who have been evaluated by her from each building in the NOAA SSMC complex. Overall, Dr. An's impressions are:

- In SSMC-2, some individuals have allergies that are worse at work (including sinus problems and asthma), others have symptoms characteristic of sick building syndrome (SBS), and others have what are clearly non-building-related symptoms. Employees came from different offices on different floors, and there was no apparent relationship between types of symptoms and location. Several employees had problems with stale or stuffy air. Some employees with asthma noted that their first symptoms appeared while they were working in the building (this was by report, and not independently verified).

- In SSMC-3, some employees reported an increased frequency of upper respiratory tract infections. Another group had SBS-type symptoms, and a third group had worsening of their allergic symptoms (including sinus congestion and infections) and asthma. On one particular floor there was a cluster of employees who noted symptoms similar to those in the rest of the building (i.e., sick building-type symptoms and allergic symptoms). However, because employees referred themselves to the physician, no statistical inferences can or should be drawn from this fact.
- In SSMC-4, employees from several floors noted SBS-type symptoms, worsening of asthma or allergies (primarily sinus problems) while in the building, or new-onset asthma or sinus problems while working in the building. Dr. An noted that there were some cases of new-onset asthma located close to the same area of one floor, although no statistical association could be tested.

Indoor Environmental Sampling

Extensive sampling has been conducted in the affected SSMC buildings over the past several years. This has included: sampling for airborne microbial volatile organic compounds (MVOCs), which are indirect indicators of microbial respiration; air sampling for mold and fungi; and specific sampling for *Stachybotrys* sp. and other molds and fungi.

Sampling for molds and fungi was performed by Nu ChemCo, Inc. in the 12th floor of SSMC-4 in May, 1999. These bulk and wipe samples demonstrated the presence of fungal contamination (*Penicillium* spp., *Stachybotrys* sp., *Cladosporium* sp.,

Sampling for MVOCs was conducted by Aerosol Monitoring & Analysis, Inc. in March and April, 1999 (reported on May 13, 1999). The results suggested possible localized growth on floors 1, 2, 6, and 7 of SSMC-4. However, the remainder of the building was felt to be within normal limits for MVOCs. In another report, dated May 27, 1999, sampling in SSMC-2 in April and May, 1999 found higher than average MVOC concentrations in the top five floors.

Sampling by the U.S. Public Health Service (USPHS) was conducted in from September through March, 2000. The results of this sampling are shown in Table 2.

Table 2. Summary of U. S. Public Health Service Environmental Monitoring at NOAA Silver Spring Metro Complex

Agency/ Report Date	Location	Sampling Period	Samples	Findings
USPHS: 8/23/99	SSMC-3-15345; test of small-scale abatement procedures	8/2/99	Wallboard bulk samples, airborne	<i>Stachybotrys chartarum</i> , <i>Penicillium</i> , <i>Cladosporium</i> in bulk samples; both <i>Stachybotrys</i> and <i>Penicillium</i> found pre-and post abatement in airborne samples
USPHS: 11/26/99	Shower, SSMC-3 Fitness Center	11/9/99	Swabs	<i>Stachybotrys chartarum</i> , <i>Aspergillus</i> sp. and <i>Asp. versicolor</i> , yeast

USPHS: 12/2/99	SSMC-2 Health Unit	10/21/99, 10/25/99	Air, contact plate, and swab samples	Airborne fungal levels less than outdoors; species similar to outdoors; <i>Penicillium</i> and <i>Aspergillus niger</i> found in surface dust; <i>Stachybotrys chartarum</i> found before cleaning in fiberglass insulation, return trougher, none found after cleaning
USPHS: 12/9/99	SSMC-3 fitness center, 9/20/99 - mechanical rooms floors 9/27/99 1-15, occupied areas 15 th floor		Tape-lift, vacuum cassette dust sampling	Sporadic fungal growth (predominantly <i>Cladosporium</i> , no <i>Stachybotrys</i>) in tape-lift samples from mechanical rooms; <i>Stachybotrys chartarum</i> found in dust samples from panel surfaces in room 15641 and carpeting in Fitness Center
USPHS: 12/9/99	SSMC-2 floors 5, 11, and 17 (surface dust vacuuming of panels or carpeting); swabs from mechanical rooms in each floor	9/23/99 - 9/27/99	Surface swab, vacuum cassette dust sampling	No <i>Stachybotrys</i> detected in vacuumed dust samples; <i>Stachybotrys</i> detected in one swab sample from access panel of fresh air supply on the 6 th floor; overall, species found in swab samples typical for office environments
USPHS: 12/9/99	SSMC-4 mechanical rooms each floor (tape-lift); occupied areas in floors 3, 4, 11, 12 (swabs); cubicles on floors 3, 4, 11, 12, 13 (vacuum dust samples)	9/21/99 - 9/23/99	Surface swab, vacuum cassette dust sampling, tape-lift	No overgrowth or <i>Stachybotrys</i> on tape-lift samples, <i>Cladosporium</i> -like spores predominate; <i>Stachybotrys chartarum</i> in 5/24 vacuum dust samples from floors 12 and 4 (carpet and paneling); no <i>Stachybotrys</i> in mechanical room swab samples; limited (2/24) swab samples positive for <i>Stachybotrys</i> in occupied areas (12 th floor, light plenums);
USPHS: 1/21/00	SSMC-3 14 th floor (ceiling tiles, wallboard, plenum dust)	11/9/99	Surface swabs, tape-lift, vacuum	High fungal levels in drywall and fiberglass insulation (predominantly <i>Penicillium</i>); high fungal levels on interior of some water-damaged drywall and plaster (predominantly <i>Stachybotrys</i>); plenum dust predominantly <i>Penicillium</i> and <i>Aspergillus</i> spp., with some <i>Stachybotrys</i>)
USPHS: 3/15/00	SSMC-3 Health Unit (supply diffuser surface swabs, plenum dust)	11/8/99 - 11/9/99	Surface swab, vacuum dust sampling	Generally low fungal levels in swabs (<i>Penicillium</i> predominant, <i>Stachybotrys</i> in one location); plenum dust predominantly <i>Penicillium</i> and <i>Aspergillus</i> , with <i>Stachybotrys</i> in most samples; findings suggested <i>Stachybotrys</i> did not originate locally

USPHS: 5/1/00	SSMC-3	2/29/00 - 3/2/00	Temper-ature, relative humidity, carbon dioxide, carbon mon-oxide, airborne fungi	Temperature ranges mid 60's to 70's; % relative humidity low- to mid-20's (except fitness center); no elevated carbon monoxide; carbon dioxide predominantly 500's - 800's, with some concentrations up to and above 1000 ppm; airborne fungi concentrations generally lower than outdoors; Stachybotrys detected in one sample in fitness center.
USPHS: 5/1/00 (DRAFT)	SSMC-2	3/16/00	Temper-ature, relative humidity, carbon dioxide, carbon mon-oxide, airborne fungi	Temperature ranges in the 70's; % relative humidity 21 - 38.7%; no elevated carbon monoxide; carbon dioxide predominantly 425 - 1,146 ppm, with 11 floors having at least some area of CO ₂ above 850 ppm; airborne fungi concentrations generally lower than outdoors; Stachybotrys detected in one sample in 8 th floor.
USPHS: 5/1/00 (DRAFT)	SSMC-IV	3/9/00	Temper-ature, relative humidity, carbon dioxide, carbon mon-oxide, airborne fungi	Temperature ranges in the 70's; % relative humidity 30.4 - 39.7%; no elevated carbon monoxide; carbon dioxide predominantly 568 - 1,156 ppm, with 6 floors having at least some area of CO ₂ above 850 ppm; airborne fungi concentrations generally lower than outdoors.
USPHS: 5/3/00 (DRAFT)	SSMC-IV; test of small-scale abatement procedures	1/19/00 and 2/7/00	Wallboard bulk samples, airborne	Stachybotrys chartarum, Penicillium, Cladosporium in bulk samples; both Stachybotrys and Penicillium found pre-and post abatement in airborne samples during drywall removal, and Stachybotrys was identified in furniture and plenum dust samples as well as carpet dust samples

Impressions

Based on the above review, the following conclusions appear warranted:

- There is no evidence of a widespread systemic illness within occupants of the building, based on the symptom sheets, reports from the Health Unit, or evaluations by the consulting occupational medicine/ internal medicine specialist. The symptoms reported by many of the occupants are consistent with a number of diagnoses, rather than one single diagnosis.
- The pattern of reported respiratory symptoms is in many cases consistent with allergic disorders including asthma and allergic rhinitis, some of which may have first developed while the occupants were in the building, and some of which was exacerbation of a pre-existing condition.
- Some individuals have symptoms that are most consistent with sick building syndrome, which is characterized by fatigue, skin irritation, headache, in some cases a dry cough, and irritated eyes.

- The symptoms experienced by individuals in the Health Unit may have been due to some acute irritant chemical exposure. There is insufficient information to identify the precise cause, but the symptoms B including the cough, irritated mucous membranes, and changes in spirometry B would be consistent with an acute irritant. There is insufficient information to determine whether there were any more chronic effects.
- There is evidence of mold growth in many areas of the buildings that have been tested. While it does not appear that one species has taken over large areas of the building (a so-called Aovergrowth@), it does appear that there are many focal areas of growth, which would be consistent with, for example, widespread moisture intrusion. This could explain a significant percentage (although not all) of the allergic symptoms reported in the building.
- The presence of *Stachybotrys* sp. has been the focus of much attention. Because *Stachybotrys* sp. is a ubiquitous organism, it is not surprising that it has been identified. It is unlikely that *Stachybotrys* sp. is the primary cause of most of the allergic conditions reported in the building, because it is less likely to be airborne than many other organisms. Furthermore, it is still not clear what, if any, specific health effects in adults may be related to *Stachybotrys* sp.. The U.S. Centers for Disease Control and Prevention (CDC) has recently reviewed and significantly revised its estimates of the risk to infants posed by *Stachybotrys* sp., based on re-analysis of data from Cleveland.[\[2\]](#) CDC concluded that there is reason to doubt that cases of infant pulmonary hemorrhage were, in fact, as strongly associated with the presence of *Stachybotrys* as had first been reported. In adults, there are some reports that suggest an association with a variety of Asick building@ conditions, but the evidence is far from strong. Therefore, it seems most appropriate to look at the presence of *Stachybotrys* sp. as an indicator that water intrusion and other building conditions have created a favorable environment for the growth of many different molds and fungi, many of which are capable of producing allergic symptoms and, in some cases, irritation to building occupants. The solution to the problem, in most instances, would be to correct the underlying conditions that created the favorable environment, regardless of whether the species is *Stachybotrys* or some other organism.

Recommendations

1. For individuals whose allergies are worse at work, if there is visible mold contamination or water intrusion (which almost by definition will increase the possibility of mold growth) these conditions should be corrected. It is always difficult to relate allergic symptoms to specific biological species; testing of individuals for specific mold allergies is unlikely to be of much value in determining whether individual mold species in the building are the cause of symptoms. Symptom reporting, in my experience, is usually more helpful than allergy testing, particularly when there are many possible offending agents.
2. From a health standpoint, additional widespread testing of the building for mold and fungi does not appear to be cost-effective. There is clearly evidence of local growth in selected areas, probably due to water intrusion; additional testing will not clarify the health issues of individual employees and seems most appropriate after a cleanup is completed, as well as part of a normal maintenance and surveillance program.
3. A number of individuals have reported symptoms consistent with sick building syndrome. While no one technical fix is likely to solve these problems, the operation and maintenance of the ventilation system should be optimized, so that obvious problems (areas of inadequate ventilation or temperature regulation, for example) can be minimized. Other environmental factors (e.g., lighting, ergonomics) may also need to be addressed.
4. The emphasis on *Stachybotrys* in the building seems, if not misplaced, at least controversial and diverting. There is clearly reason to be concerned about the fact that conditions in the building are favorable for mold growth and potentially overgrowth. Health problems may be expected when such conditions exist, regardless of whether *Stachybotrys* is present. While not discounting the importance of proper abatement when it is identified, its absence should not be an excuse for lessened concern.
5. Additional testing for other possible environmental contaminants commonly found in offices, for example particulate levels or fiberglass, may be appropriate but ought to be guided by visual inspection of the building

or symptoms reported by building occupants.

6. Workers involved in remediation of affected areas should use appropriate personal protective equipment and have appropriate training. The newly revised guidelines from the New York City Department of Health are useful in their general approach, although some adaptation to this site may be required.^[3]

Conclusion

The three structures of the Silver Spring Metro Complex investigated in this report have indoor environmental problems related in part to moisture and subsequent mold growth. Occupants of the buildings have reported allergies and sick building syndrome-type symptoms. Allergy symptoms may well be related in part to building-related factors described above, although personal medical histories may also contribute to these problems. Sick building syndrome-type symptoms should prompt a review of area ventilation system operating characteristics, as well as other potential localized sources of problems. Further investigation of the building should be guided by: (1) reports of problems from building occupants; (2) visual inspections; and (3) confirmation of effective abatement of previously reported problem areas. Workers involved in abatement should have proper training and use appropriate personal protective equipment and isolation techniques. Building occupants should continue to be encouraged to report problems to the Health Unit and building management, so there is a mechanism to address and repair problems in a timely fashion.

^[1]Samet JM, Spengler JD, Mitchell CS. Indoor air pollution. In: Rom WN (ed.). AEnvironmental and Occupational Medicine (3rd edition). 1998. Philadelphia: Lippincott-Raven. 1523-1537.

^[2]CDC. Update: pulmonary hemorrhage/hemosiderosis among infants C Cleveland, Ohio, 1993-1996. MMWR 2000;49(9):180-184. (<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/mm4909a3.htm>)

^[3]New York City Department of Health. Guidelines on Assessment and Remediation of Fungi in Indoor Environments. New York City Department of Health, April 2000. (<http://www.ci/nyc.ny.us/health>)